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EXAMINER
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KIM, PAUL

ART UNIT	PAPER NUMBER
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2161

NOTIFICATION DATE	DELIVERY MODE
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ELECTRONIC

**Please find below and/or attached an Office communication concerning this application or proceeding.**

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

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<b>Office Action Summary</b>	<b>Application No.</b> 10/670,083	<b>Applicant(s)</b> XU ET AL.	
	<b>Examiner</b> PAUL KIM	<b>Art Unit</b> 2161	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

### Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

### Status

- 1) ☒ Responsive to communication(s) filed on 24 April 2008.
- 2a) ☒ This action is **FINAL**.                      2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

### Disposition of Claims

- 4) ☒ Claim(s) 1-25 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-25 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

### Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

### Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All    b) ☐ Some \*    c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
  2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

### Attachment(s)

- |  |   |
|--|---|
| 1) <input type="checkbox"/> Notice of References Cited (PTO-892)                     | 4) <input type="checkbox"/> Interview Summary (PTO-413)           |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | Paper No(s)/Mail Date. _____                                      |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08)          | 5) <input type="checkbox"/> Notice of Informal Patent Application |
| Paper No(s)/Mail Date _____  | 6) <input type="checkbox"/> Other: _____                          |

### **DETAILED ACTION**

1. This Office action is responsive to the following communication: Amendment filed on 24 April 2008.
2. Claims 1-25 are pending and present for examination.

### ***Response to Amendment***

3. No claims have been amended.
4. No claims have been cancelled.
5. No claims have been added.

### ***Claim Rejections - 35 USC § 103***

6. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

7. **Claims 1-3, 5, 8, 13 and 23** are rejected under 35 U.S.C. 103(a) as being unpatentable over Yourlo (U.S. Patent No. 6,201,176, hereinafter referred to as YOURLO), filed on 21 April 1999, and issued on 13 March 2001, in view of Logan et al (U.S. Patent No. 7,031,980, hereinafter referred to as LOGAN), filed on 31 October 2001, and issued on 18 April 2006.

8. **As per independent claims 1 and 23**, YOURLO, in combination with LOGAN, discloses:

A method of representing audio/musical information in a digital representation suitable for use in content-based information indexing and retrieval, the method comprising:

- a) determining a first representation including a set of peaks and valleys corresponding to maximum and minimum values respectively of at least one characteristic of the audio/music {See YOURLO, Figure 11; and C9:L46-51, wherein this reads over "a histogram of dominant pitches present in the original music is formed"}; and

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- b) determining a second representation including values representing relative differences between the determined peaks and valleys {See LOGAN, C8:L23-52, wherein this reads over "[f]or each song, the present invention then constructs a histogram of important features exhibited in the beat spectrogram" and "the present invention can construct a histogram of the distance between peaks in the averaged lag vectors"}.

The Examiner notes that wherein a representation includes a set of peaks, the representation would inherently include valleys. Additionally, while YOURLO may fail to expressly disclose the representation of relative differences between the determined peaks and valleys, LOGAN discloses a method wherein a histogram of relative distances between peaks may be constructed. Furthermore, it would have been obvious to one of ordinary skill in the art that the construction of a histogram of the distance between valleys may also be determined. The combination of invention disclosed by YOURLO and LOGAN would disclose a method of determining the aforementioned first and second representations. Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the above invention disclosed by YOURLO by combining it with the invention disclosed by LOGAN.

One of ordinary skill in the art would have been motivated to do this modification so that representations of a set of peaks/valleys and relative differences between the determined peaks and valleys may be constructed.

9. **As per dependent claims 2 and 5, YOURLO, in combination with LOGAN, discloses:**

A method as claimed in claim 1, further including: c) determining a histogram of the first representation {See YOURLO, Figure 11; and C9:L46-51, wherein this reads over "a histogram of dominant pitches present in the original music is formed"}.

10. **As per dependent claim 3, YOURLO, in combination with LOGAN, discloses:**

A method as claimed in claim 2, wherein the histogram of the first representation includes a representation of, the population, or duration, of peaks or valleys in a given time interval {See YOURLO, Figures 11 and 12; and C8:L58-63, wherein this reads over "represented in the form of a histogram covering the entire period of interest for the signal being considered"}.

11. **As per dependent claim 8, YOURLO, in combination with LOGAN, discloses:**

A method as claimed in claim 1, wherein the audio/musical information is an acoustic signal {See YOURLO, C4:L51-65}.

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12. **As per dependent claim 13**, YOURLO, in combination with LOGAN, discloses:

A method as claimed in claim 1, wherein the characteristic of the audio/music is any one or more of the following: volume level; pitch {See YOURLO, C9:L30-33, wherein this reads over "[p]itch is another feature in the present embodiment determined by the feature extraction means"}; and interval information.

13. **Claims 4, 6 and 9** are rejected under 35 U.S.C. 103(a) as being unpatentable over YOURLO, in view of LOGAN, as applied to claims 1-3, 5, 8, 13 AND 23 above, and further in view of Official Notice.

14. **As per dependent claim 4**, the Examiner takes Official Notice that it would have been widely-known to one of ordinary skill in the art that the relative difference values would have been the difference between the magnitude of valleys and peaks. It would have been obvious to one of ordinary skill in the art to use the difference values such that of audio/musical information may be appropriately represented in digital format

15. **As per dependent claim 6**, the Examiner takes Official Notice that it would have been widely-known to one of ordinary skill in the art that the audio/musical information is a music score. It would have been obvious to one of ordinary skill in the art to use a music score as music scores (i.e. sheet music) are commonly used to record a piece of music.

16. **As per dependent claim 9**, the Examiner takes Official Notice that it would have been widely-known to one of ordinary skill in the art that the acoustic signal be either a vocal or humming signal.

17. **Claim 10** is rejected under 35 U.S.C. 103(a) as being unpatentable over YOURLO, in view of LOGAN, as applied to claims 1-3, 5, 8, 13 AND 23 above, and further in view of Williams (U.S. Patent No. 5,825,754, hereinafter referred to as WILLIAMS), filed on 28 December 1995, and issued on 20 October 1998.

18. **As per dependent claim 10**, YOURLO, in combination with LOGAN and WILLIAMS, discloses:

A method as claimed in claim 8, further including preprocessing the acoustic signal before performing a), wherein the pre-processing includes:

converting the acoustic signal to a digital signal {See WILLIAMS, C3:L35-42, wherein this reads over "a digital signal processor"};

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removing noise from the digital signal {See WILLIAMS, C4:L6-35, wherein this reads over "filter 10 receives an audio signal input . . . [and] processes these audio signals to accomplish multi-band echo canceling and noise reduction"};

subjecting the noise free digital signal to pitch detection {See YOURLO, C9:L30-33, wherein this reads over "[p]itch is another feature in the present embodiment determined by the feature extraction means"}; and

subjecting the pitch detected digital signal to interval or note detection {See YOURLO, col. 9, lines 30-49, wherein this reads over "[t]he localized pitch is determined over a small window", "the filters are spaced at intervals determined by the rate at which the original musical signal was sampled. The sampled signal is filtered through the filter bank, and the comb filter that has the greatest output power will have a resonant frequency corresponding to the dominant pitch over the window"}.

The combination of inventions disclosed by YOURLO, LOGAN, and WILLIAMS would disclose a method wherein the acoustic signal is preprocessed to remove noise and subsequently subjected to pitch detection and interval detection. Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the above inventions disclosed by YOURLO and LOGAN by combining them with the invention as disclosed by WILLIAMS.

One of ordinary skill in the art would have been motivated to do this modification so that the acoustic signal may be cleaned of noise such that a more accurate detection of the pitch, interval, or note may be accomplished.

19. **Claims 11 and 12** are rejected under 35 U.S.C. 103(a) as being unpatentable over YOURLO, in view of LOGAN and WILLIAMS, as applied to claim 10 above, and in further view of Official Notice.

20. **As per dependent claim 11**, the Examiner takes Official Notice that it would have been widely-known to one of ordinary skill in the art to apply a windowed Fourier transform and auto-correlation of the noise free digital signal. It would have been obvious to one of ordinary skill in the art to use a windowed Fourier transform as a windowed Fourier transform is used to obtain both time and frequency localization. Additionally, it would have been obvious to one of ordinary skill in the art to use autocorrelation since autocorrelation is a mathematical tool used frequently in signal processing for analyzing functions or series of values.

21. **As per dependent claim 11**, the Examiner takes Official Notice that it would have been widely-known to one of ordinary skill in the art to logarithmically scalre the pitch detected digital signal.

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22. **Claim 13** is rejected under 35 U.S.C. 103(a) as being unpatentable over YOURLO, in view of LOGAN, as applied to claims 1-3, 5, 8, 13 AND 23 above, and further in view of Takenaka et al (U.S. patent No. 6,807,450, hereinafter referred to as TAKENAKA), filed 5 January 1999, and issued on 19 October 2004.

23. **As per dependent claim 13**, YOURLO, in combination with LOGAN and TAKENAKA, discloses:

A method as claimed in claim 6, further including pre-processing the music score before performing a), wherein the pre-processing includes: removing zero notes from the music score, and; adjoining the remaining nonzero notes to fill any gaps left by the removed zero notes {See TAKENAKA, C7:L47-53, wherein this reads over "[t]he linking function is a function that links a plurality of compressed information pieces by removing a silent portion (that is ,a blank portion) between the compressed information pieces"}.

The combination of inventions disclosed by YOURLO, LOGAN, and TAKENAKA would disclose a method wherein the music score is pre-processed by removing zero notes or silence from the music score. Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the above inventions disclosed by YOURLO and LOGAN by combining them with the invention as disclosed by TAKENAKA.

One of ordinary skill in the art would have been motivated to do this modification so that the music score may be condensed by removing silent notes.

24. **Claims 14-16**, are rejected under 35 U.S.C. 103(a) as being unpatentable over YOURLO, in view of McNab et al (NPL, "Tune Retrieval in the Multimedia Library," University of Waikata, Hamilton, New Zealand, published in 1996, hereinafter referred to as MCNAB), and Ghias et al (NPL, "Query By Humming," Proc ACM Multimedia 95, San Francisco, hereinafter referred to as GHIAS).

25. **As per independent claims 14 and 16**, YOURLO, in combination with LOGAN, MCNAB and GHIAS, discloses:

A method of creating a music score database, comprising:

representing an actual music track uniquely with a music score such that there is a link between the music score and the actual music track;

representing the music score in accordance with a representing method to form search keywords, wherein the representing method is adapted to represent audio/musical information in a digital representation suitable for use in content-

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based information indexing and retrieval {See GHIAS, p. 4, Para. 5-11, wherein this reads over "[s]ongs in the database are preprocessed to convert the melody into a stream of U, D, S characters, and the converted user input is compared with all the songs"}, the representing method comprising:

determining a first representation including a set of peaks and valleys corresponding to maximum and minimum values respectively of at least one characteristic of the audio/music {See YOURLO, Figure 11; and C9:L46-51, wherein this reads over " a histogram of dominant pitches present in the original music is formed" }; and

determining a second representation including values representing relative differences between the determined peaks and valleys, wherein the audio/musical information is the music score {See LOGAN, C8:L23-52, wherein this reads over " [f]or each song, the present invention then constructs a histogram of important features exhibited in the beat spectrogram" and " the present invention can construct a histogram of the distance between peaks in the averaged lag vectors" }; and

storing the search keywords in a database {See GHIAS, p. 4, Para. 5-11, wherein this reads over "[s]ongs in the database are preprocessed to convert the melody into a stream of U, D, S characters, and the converted user input is compared with all the songs"}.

The Examiner notes that it would be inherent to the claimed invention that a music score be used in the representation of an actual music track. Additionally, the combination of inventions disclosed in YOURLO, LOGAN, MCNAB, and GHIAS would disclose a method of creating a music score database. Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the above invention suggested by YOURLO by combining it with the inventions disclosed by LOGAN, MCNAB, and GHIAS.

One of ordinary skill in the art would have been motivated to do this modification so that the database may be search for a matching music track according to the representations of the peaks and valleys of the inputted audio/music.

26. **As per dependent claim 15**, YOURLO, in combination with LOGAN, MCNAB and GHIAS, discloses:

A method further including:

creating at least one index for storage with the database {See MCNAB, p. 7, Para. 3, wherein this reads over "an index of melodies based entirely on the sequence of interval directions, which is called the 'melodic contour' or 'pitch profile'"},



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the at least one index including a global feature corresponding to an entire music SCORE {See MCNAB, p. 7, Para. 2, wherein this reads over "string matching on the score database in order to retrieve music"} wherein the global feature includes the histogram {See YOURLO, Figures 11 and 12; col. 8, lines 58-63, wherein this reads over "represented in the form of a histogram covering the entire period of interest for the signal being considered"; and col. 9, lines 46-48, wherein this reads over "[f]rom these resulting pitches, a histogram of dominant pitches present in the original music is formed"} of the second representation {See GHIAS, p. 4, Para. 5-11, wherein this reads over "[s]ongs in the database are preprocessed to convert the melody into a stream of U, D, S characters, and the converted user input is compared with all the songs"}.

The combination of inventions disclosed in YOURLO, LOGAN, MCNAB, and GHIAS would disclose a method for creating an index in a database, wherein the index includes a global feature corresponding to a music score. Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the above invention suggested by YOURLO by combining it with the inventions disclosed by LOGAN, MCNAB, and GHIAS.

One of ordinary skill in the art would have been motivated to do this modification so that the index may be accessed in the search process.

27. **Claim 17** is rejected under 35 U.S.C. 103(a) as being unpatentable over GHIAS, in view of Schuetze et al (USPGPUB No. 2003/0074369, hereinafter referred to as SCHUETZE), filed on 19 October 1999, and published on 17 April 2003.

28. **As per independent claim 17**, GHIAS, in combination with SCHUETZE, discloses:

A method of retrieving audio/music information from a music score database, by matching query keywords with database keywords, the method comprising:

- a) comparing a query keyword, created from an acoustic input for retrieval of music information in a music score database, with a global feature corresponding to each music score to eliminate non-relevant database keywords {See GHIAS, p. 4, Para. 5-11, wherein this reads over "[s]ongs in the database are preprocessed to convert the melody into a stream of U, D, S characters, and the converted user input is compared with all the songs"};
- b) comparing the second representation of the query with the second representation of each database keyword {See GHIAS, p. 4, Para. 5-11, wherein this reads over "[s]ongs in the database are preprocessed to convert the melody into a stream of U, D, S characters, and the converted user input is compared with all the songs"}; and
- c) comparing the histogram of the first representation of the query with the histogram of the first representation of each database keyword {See SCHUETZE, Para. [0163], wherein this reads over "[f]or example, as discussed above, the cosine distance can be used for text feature similarity, while Euclidean distance or the normalized histogram intersection is used for histogram similarity"}.

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The combination of inventions disclosed in GHIAS and SCHUETZE would disclose a method of matching query keywords with music score keywords. Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the above invention suggested by GHIAS by combining it with the invention disclosed by SCHUETZE.

One of ordinary skill in the art would have been motivated to do this modification so that matches may be retrieved by histogram intersection.

29. **Claims 18 and 24 are** rejected under 35 U.S.C. 103(a) as being unpatentable over YOURLO, in view of LOGAN, in further view of MCNAB, in further view of GHIAS.

30. **As per independent claims 18 and 24**, YOURLO, in combination with MCNAB and GHIAS, discloses:

A method of creating a music score database, comprising:

- a) using a music score to uniquely represent an actual music song such that there is a link provided between a music score database and a music database {See MCNAB, p. 7, Para. 2, wherein this reads over "string matching on the score database in order to retrieve music"};
- b) using a curve including a set of digital values to represent the music score information {See GHIAS, Figures 1-3}; and
- c) using peaks and valleys {See YOURLO, Figure 11; and C9:L46-51, wherein this reads over "a histogram of dominant pitches present in the original music is formed"} of the curve so as to index the music score database {See GHIAS, p. 4, Para. 5-11, wherein this reads over "[s]ongs in the database are preprocessed to convert the melody into a stream of U, D, S characters, and the converted user input is compared with all the songs"}.

The Examiner notes that it would be inherent to the claimed invention that a music score be used in the representation of an actual music track. The combination of inventions disclosed in YOURLO, MCNAB and GHIAS would disclose a method of creating a music score database. Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the above invention suggested by YOURLO by combining it with the inventions disclosed by MCNAB and GHIAS.

One of ordinary skill in the art would have been motivated to do this modification so that music score information may be indexed according to the peaks and valleys of the audio input.

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31. **Claims 19 and 25** are rejected under 35 U.S.C. 103(a) as being unpatentable over MCNAB, in view of YOURLO, in further view of MCNAB, and in further view of GHIAS.

32. **As per independent claims 19 and 25**, YOURLO, in combination with LOGAN, MCNAB, and GHIAS, discloses:

A method of converting a music score into score keywords, comprising:

- a) preprocessing a score curve so as to remove zero notes, the score curve including a set of digital values representing musical notes {See MCNAB, p. 9, Para. 1, wherein this reads over "[d]eletion and insertion can be handled by transforming a note to a notional zero-length note, and vice versa"};
- b) detecting peaks and valleys of the score curve {See YOURLO, Figure 11; and C9:L46-51, wherein this reads over "a histogram of dominant pitches present in the original music is formed"};
- c) calculating the distance between each peak/valley and valley/peak pair {See LOGAN, C8:L23-52, wherein this reads over "[f]or each song, the present invention then constructs a histogram of important features exhibited in the beat spectrogram" and "the present invention can construct a histogram of the distance between peaks in the averaged lag vectors"}; and
- d) using the peaks and valleys as reference points {See YOURLO, Figures 11 and 12; col. 8, lines 58-63, wherein this reads over "represented in the form of a histogram covering the entire period of interest for the signal being considered"; and col. 9, lines 46-48, wherein this reads over "[f]rom these resulting pitches, a histogram of dominant pitches present in the original music is formed"}, and a note histogram of the peaks and valleys to serve as score keywords {See GHIAS, p. 4, Para. 5-11, wherein this reads over "[s]ongs in the database are preprocessed to convert the melody into a stream of U, D, S characters, and the converted user input is compared with all the songs"}.

The combination of inventions disclosed in YOURLO, LOGAN, MCNAB, and GHIAS would disclose a method of converting a music score into score keywords by using the peaks and valleys as reference points. Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the above invention suggested by YOURLO by combining it with the inventions disclosed by LOGAN, MCNAB, and GHIAS.

One of ordinary skill in the art would have been motivated to do this modification so that score keywords may be used in searching the music score database.

33. **Claim 20** is rejected under 35 U.S.C. 103(a) as being unpatentable over MCNAB, in view of YOURLO, and in further view of Varne (U.S. Patent No. 6,831,220, hereinafter referred to as VARME), filed on November 6, 2003, claiming priority to April 6, 2000.

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34. **As per independent claim 20**, MCNAB, in view of YOURLO and VARME, discloses:

A method of creating indexes to organise a music score database created in accordance with a method, comprising:

constructing a global feature for the complete actual music song, wherein the global feature is the histogram of the values of the distances between each peak/valley and valley/peak pair {See YOURLO, Figures 11 and 12; col. 8, lines 58-63, wherein this reads over "represented in the form of a histogram covering the entire period of interest for the signal being considered"; and col. 9, lines 46-48, wherein this reads over "[f]rom these resulting pitches, a histogram of dominant pitches present in the original music is formed"},

wherein the music score database creating method comprises:

using a music score to uniquely represent an actual music song such that there is a link provided between a music score database and a music database {See MCNAB, p. 7, Para. 2, wherein this reads over "string matching on the score database in order to retrieve music"};

using a curve including a set of digital values to represent the music score information {See VARME, col. 2, lines 20-22, wherein this reads "musical notation system for creating colored music scores and colored musical instruments"; and col. 2, lines 41-45, wherein this reads over "music score includes notes which form a musical arrangement"}; and

using peaks and valleys of the curve so as to index the music score database {See MCNAB, p. 7, Para. 3, wherein this reads over "[w]hat attributes should be used when searching a musical score database?", "conducting the search on the basis of pitch ratios, or musical intervals", and "an index of melodies based entirely on the sequence of interval directions, which is called the 'melodic contour' or 'pitch profile'".

The combination of inventions disclosed in MCNAB, YOURLO, and VARME would disclose a method of creating indexes to organize a music score database. Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the above invention suggested by BLUM by combining it with the inventions disclosed by MCNAB, YOURLO, and VARME.

One of ordinary skill in the art would have been motivated to do this modification so that a music score database may be created using the peaks and valley of the audio input curve.

35. **Claim 21** is rejected under 35 U.S.C. 103(a) as being unpatentable over YOURLO, in view of LOGAN, in further view of GHIAS, in further view of MCNAB, and in further view of Foote (U.S. Patent No. 6,542,869, hereinafter referred to as FOOTE), filed on May 11, 2000, and issued on April 1, 2003.

36. **As per independent claim 21**, YOURLO, in combination with LOGAN, GHIAS, MCNAB, and FOOTE, discloses:

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A method of automatically converting acoustic input in the form of humming into query keywords {See GHIAS, p. 2, Para. 3, wherein this reads over "how user input to the system (humming) is converted into a sequence of relative pitch transitions}, comprising:

- a) converting the acoustic input into digital signal {See GHIAS, Figure 1; and p. 2, Para. 1, wherein this reads over "[q]ueries are hummed into a microphone, digitized, and fed into a pitch-tracking module";
- b) detecting the pitch from the digital signal {See GHIAS, Equations 1 and 2; p. 2, Para. 2, wherein this reads over "[p]itch tracking is performed in Matlab, chosen for its built-in audio processing capabilities and the ease of testing a number of algorithms"; and Paras. 3-8};
- c) converting the pitch into notes {See MCNAB, p. 4, Paras. 3 and 4, wherein this reads over "MIDI note representations", "[s]ince musical units – octaves, cents and so forth – are relative measures" and "MIDI (Musical Instruments Digital Interface) is a standard for controlling and communicating with electronic musical instruments";
- d) representing the acoustic input by a pitch curve {See GHIAS, Figure 2};
- e) smoothing of the pitch curve by removing small peaks and valleys {See FOOTE, col. 3, line 65 – col. 4, line 9, wherein this reads over "each analysis frame is windowed with a 256-point Hamming window and a Fast Fourier transform is used for parameterization to estimate the spectra components in the window. The logarithm of the magnitude of the result of the FFT is used as an estimate of the power spectrum of the signal in the window";
- f) detecting peaks and valleys of the pitch curve {See BLUM, Figure 4; col. 6, lines 24-28, wherein this reads over "[t]he analysis method will compute new arrays of data values (called trajectories), specifying . . . pitch"; and col. 9, lines 1-41, wherein this reads over "[t]he magnitude spectrum is analyzed to find the peaks"; and
- g) generating the query keywords using the peaks and valleys in accordance with a method {See GHIAS, p. 4, Para. 5-11, wherein this reads over "[s]ongs in the database are preprocessed to convert the melody into a stream of U, D, S characters, and the converted user input is compared with all the songs"}, wherein the method comprises

calculating the distance between each peak/valley and valley/peak pair {See LOGAN, C8:L23-52, wherein this reads over "[f]or each song, the present invention then constructs a histogram of important features exhibited in the beat spectrogram" and "the present invention can construct a histogram of the distance between peaks in the averaged lag vectors"; and

using the peaks and valleys as reference points, and a note histogram of the peaks and valleys to serve as score keywords {See YOURLO, Figures 11 and 12; and col. 9, lines 46-48, wherein this reads over "[f]rom these resulting pitches, a histogram of dominant pitches present in the original music is formed".

The combination of inventions disclosed in YOURLO, LOGAN, MCNAB, GHIAS and FOOTE would disclose a method of automatically converting acoustic input in the form of humming into query keywords. Therefore, it would have been obvious to one of ordinary skill in the art at the time the

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invention was made to modify the above invention suggested by YOURLO by combining it with the inventions disclosed by LOGAN, MCNAB, GHIAS, and FOOTE.

One of ordinary skill in the art would have been motivated to do this modification so that a user may hum in an acoustic input, which may be then analyzed and converted into query keywords.

37. **Claim 22** is rejected under 35 U.S.C. 103(a) as being unpatentable over YOURLO, in view of GHIAS, and in further view of SCHUETZE.

38. **As per independent claim 22**, GHIAS, in view of YOURLO and SCHUETZE, discloses:

A method of matching query keywords with music score keywords, comprising:

- a) checking a global feature for the complete actual music song, wherein the global feature is the histogram of the values of the distances between each peak/valley and valley/peak pair {See YOURLO, Figures 11 and 12; col. 8, lines 58-63, wherein this reads over "represented in the form of a histogram covering the entire period of interest for the signal being considered"; and col. 9, lines 46-48, wherein this reads over "[f]rom these resulting pitches, a histogram of dominant pitches present in the original music is formed"};
- b) matching the sequence of peak/valley distance values of the query and the peak/valley distance values of the music score keywords {See GHIAS, p. 4, Para. 5-11, wherein this reads over "[s]ongs in the database are preprocessed to convert the melody into a stream of U, D, S characters, and the converted user input is compared with all the songs"}; and
- c) matching the note histogram by histogram intersection {See SCHUETZE, Para. [0163], wherein this reads over "[f]or example, as discussed above, the cosine distance can be used for text feature similarity, while Euclidean distance or the normalized histogram intersection is used for histogram similarity"}.

The combination of inventions disclosed in GHIAS, YOURLO, and SCHUETZE would disclose a method of matching query keywords with music score keywords. Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the above invention suggested by YOURLO by combining it with the inventions disclosed by GHIAS and SCHUETZE.

One of ordinary skill in the art would have been motivated to do this modification so that matches may be retrieved by histogram intersection.

### ***Response to Arguments***

39. Applicant's arguments filed 24 April 2008 have been fully considered but they are not persuasive.

- a. Rejections under 35 U.S.C. 103 – Claims 1, 14, 16, 18, 19, 21, 23, 24 and 25

Applicant asserts the argument that the combination of Yourlo and Logan fail to disclose "a first representation including a set of peaks and valleys corresponding to maximum and minimum values respectively of at least one characteristic of the audio/music." See Amendment, page 9-10.

Firstly, Applicant asserts the argument that "a histogram of dominant pitch is not a representation of music that is comparable to features, such as for example melody, that are obtainable by determining peak and valleys." See Amendment, page 9. The Examiner respectfully disagrees. In response to applicant's argument that the references fail to show certain features of applicant's invention, it is noted that the features upon which applicant relies (i.e., music features such as melody) are not recited in the rejected claim(s). Although the claims are interpreted in light of the specification, limitations from the specification are not read into the claims. See *In re Van Geuns*, 988 F.2d 1181, 26 USPQ2d 1057 (Fed. Cir. 1993). That is, the recited language of the claim 1 is only directly to "one characteristic of the audio/music." For the purposes of this examination, it is noted that under the broadest reasonable interpretation, a dominant pitch would read upon a characteristic of audio or music to one of ordinary skill in the art.

Secondly, Applicant asserts the argument that "Logan refers to energy or magnitude of notes, and has nothing to do with pitch as concerned in Yourlo or melody." See Amendment, page 10. The Examiner respectfully disagrees in that while the disclosed invention in Logan applies to a rhythm similarity measure, Logan disclose a method for calculating the distance between histograms. See Logan, col. 10, lines 17-32. Therefore, it would have been obvious to one of ordinary skill in the art to combine the histogram of pitches disclosed in Yourlo with the histogram comparison as disclosed by Logan.

Accordingly, the rejections of claims 1, 14, 16, 18, 19, 21, 23, 24 and 25 under 35 U.S.C. 103 are sustained.

b. Rejections under 35 U.S.C. 103 – Claim 17

Applicant asserts the argument that “the combination of Ghias and Schuetze fails to teach at least one feature of claim 17 because there is no teaching the cited prior documents to motivate a person of ordinary skill to combine the teaching of Ghias and Schuetze.” See Amendment, page 11. The Examiner respectfully disagrees. In response to applicant's argument that there is no suggestion to combine the references, the examiner recognizes that obviousness can only be established by combining or modifying the teachings of the prior art to produce the claimed invention where there is some teaching, suggestion, or motivation to do so found either in the references themselves or in the knowledge generally available to one of ordinary skill in the art. See *In re Fine*, 837 F.2d 1071, 5 USPQ2d 1596 (Fed. Cir. 1988) and *In re Jones*, 958 F.2d 347, 21 USPQ2d 1941 (Fed. Cir. 1992). In this case, Schuetze discloses a method for determining the similarity of histograms by calculating the distances or the number of intersections between the histograms. Accordingly, the histogram of the query and the histogram of the database keyword may both be compared using the aforementioned method as disclosed by Schuetze.

Accordingly, the rejection of claim 17 under 35 U.S.C. 103 is sustained.

c. Rejections under 35 U.S.C. 103 – Claim 20

Applicant asserts the argument that the prior art citations fail to disclose the feature of “using a curve including a set of digital values to represent the music information, and using peaks and valleys of the curve so as to index the music score database.” See Amendment, page 12. The Examiner respectfully disagrees in that McNab discloses the use of a “melodic contour” or “pitch profile.” See McNab, page 7. It is noted that the melodic contour is defined by a string of notes that make up the melody. Said melodic contour may be in the form of a curve wherein said curve comprises a set of melodic notes (i.e. digital values which represent a music score).



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Therefore, McNAb indeed discloses the claimed feature of "using a curve including a set of digital values to represent the music score information."

Accordingly, the rejection of claim 20 under 35 U.S.C. 103 is sustained.

d. Rejections under 35 U.S.C. 103 – Claim 22

Applicant asserts the argument that the combination of the cited prior art references fails to disclose "that the histogram is of the features of the distances between each peak/valley and valley/peak." See Amendment, page 13. The Examiner respectfully disagrees in that wherein Yourlo discloses a histogram which plots a set of dominant pitches, said histogram may contain a set of peaks and valleys. Accordingly, it would be inherent that there exist a set of distances between each of the plotted peaks (i.e. high pitches) and valleys (i.e. low pitches).

Accordingly, the rejection of claim 22 under 35 U.S.C. 103 is sustained.

***Conclusion***

40. **THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

41. Any inquiry concerning this communication or earlier communications from the examiner should be directed to PAUL KIM whose telephone number is (571)272-2737. The examiner can normally be reached on M-F, 9am - 5pm.

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If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Apu Mofiz can be reached on (571) 272-4080. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

Paul Kim  
Examiner, Art Unit 2161  
TECH Center 2100

/pk/

/Apu M Mofiz/

Supervisory Patent Examiner, Art Unit 2161